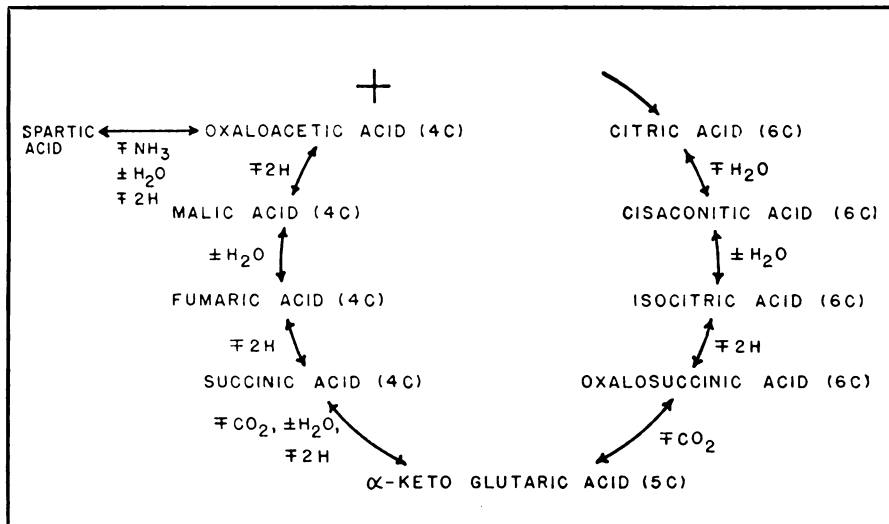


# Krebs cycle and the primordial soup



All the chemicals in the Krebs cycle, with the possible exception of alpha-keto glutaric acid, were produced outside cells under early earth conditions.

Products of one of the most crucial biochemical pathways of modern cells—the Krebs cycle—have been produced outside of cells under conditions that simulate those thought to have existed in the early stages of the earth's history. Up to now, only amino acids, the building blocks of life, and components of nucleic acids, the genetic material of life, have been so synthesized.

The finding, by Cyril Ponnampneruma and his associates at the University of Maryland's Laboratory of Chemical Evolution, was reported this week at a regional meeting of the American Chemical Society in Wilkes Barre, Pa.

Ponnampneruma, one of the pioneers in the study of the evolution of prelife chemicals on the primitive earth, considers his team's discovery "a very interesting and important new development." It suggests that "when life began, it did not perhaps invent the cycle, but used the pathway that was already there chemically."

Scientists believe the earth is about 4.7 billion years old, and that the first forms of life were present on earth 3.5 to 3.2 billion years ago. So they are anxious to know what happened during the preceding 1.2 billion years. They want to know what chemicals in the primitive earth atmosphere or ocean became the building blocks and genes of life. To find out, they've conducted various experiments under simulated early earth conditions and have discovered that amino acids and nucleic acids could have indeed been formed under such conditions.

Major components of nucleic acids are chemicals known as pyrimidines. Ponnampneruma and his co-workers were looking for a prebiotic (early

earth) source of malic acid that is believed to be a prebiotic precursor of the pyrimidines. They already knew that malic acid can be made from acetic acid, and that acetic acid can be made from methane, ammonia and water—purported components of the primitive earth atmosphere. So in a

series of experiments they took acetic acid and exposed it to radiation. One of the products they got was expected: malic acid. Malic acid is also one of the products of the Krebs cycle. But they also got what they didn't expect: other products of the cycle—citric acid, cisaconitic acid, isocitric acid, oxalosuccinic acid, succinic acid, fumaric acid and oxaloacetic acid. The only product of the cycle they are not sure they got is alpha-keto glutaric acid.

"It is something that fell on us," Ponnampneruma recalls. "We were not looking for the Krebs cycle acids."

The Krebs cycle is the powerhouse of the cell. Proteins, fats and carbohydrates are broken down into pyruvic acid and acetyl coenzyme A. They then enter the Krebs mill whereby, in the presence of oxygen, they are changed into citric acid, cisaconitic acid and the other compounds with high-energy potential.

So if these preliminary results are extended and confirmed they strongly suggest, as the Maryland chemist says, that "life did not have to invent these metabolic processes, but took up sequences that were already available." In other words, the Krebs cycle may be used by modern cells because the first cells on earth used chemicals that were easily available to them in their environment. □

## Westar and the war of the talksats

After seven years of tedious, albeit sometimes heated, deliberation, the Federal Communications Commission decided last September that any qualified corporation would be eligible to operate a commercial satellite communications system in the United States. The race was on. RCA made the first splash in January by leasing space on the Anik II satellite of Canada's Telesat system (SN: 1/19/74, p. 41), and now the first U.S. commercial comsat for domestic use is in orbit.

Westar I went into space on April 13, owned and operated by Western Union, which has lost no time in publicizing the accomplishment. This summer, Westar II is scheduled to follow.

Commercial comsats are the latest threat to American Telephone and Telegraph's virtual monopoly in U.S. telecommunications. The competition is brutal: RCA's leased satellite circuits offer savings sometimes exceeding 25 percent over land lines. American Satellite Corp., which has apparently dropped plans to orbit its own satellites, is leasing space on the Westars, at a rate believed to be 36 percent less than the Canadian charge to RCA. Next year, RCA will tighten things further by launching two satellites of its own (with twice the capacities of the Aniks and Westars), and AT&T will try to

reassert its position when it joins with General Telephone and Electronics to lease all the space on three satellites to be launched in 1975 and 1976 for COMSAT General. (COMSAT General is the domestic subsidiary of COMSAT Corp., the U.S. member of the multinational INTELSAT Corp.) The AT&T-GT&E alliance is the improbable offspring of a bitter rivalry in which each company had planned to orbit a satellite system of its own.

Private personal phone calls may be least affected by the domestic satellite revolution. Private business circuits, now largely land lines leased from AT&T, are a more likely target, as are military and business data links, which have been predicted to grow into a \$5 billion annual market by 1980.

It looks like trouble for Ma Bell, and probably will be, but the future is not all golden for the proliferating satelliters either. It may take seductively low rates and high-pressure salesmanship, for example, to interest the major television networks in substantial usage of domestic satellites; news and sports events happen in so many different places that the cost and practicality of portable ground equipment to reach the satellites could be a major factor.

Furthermore, it may be a case of